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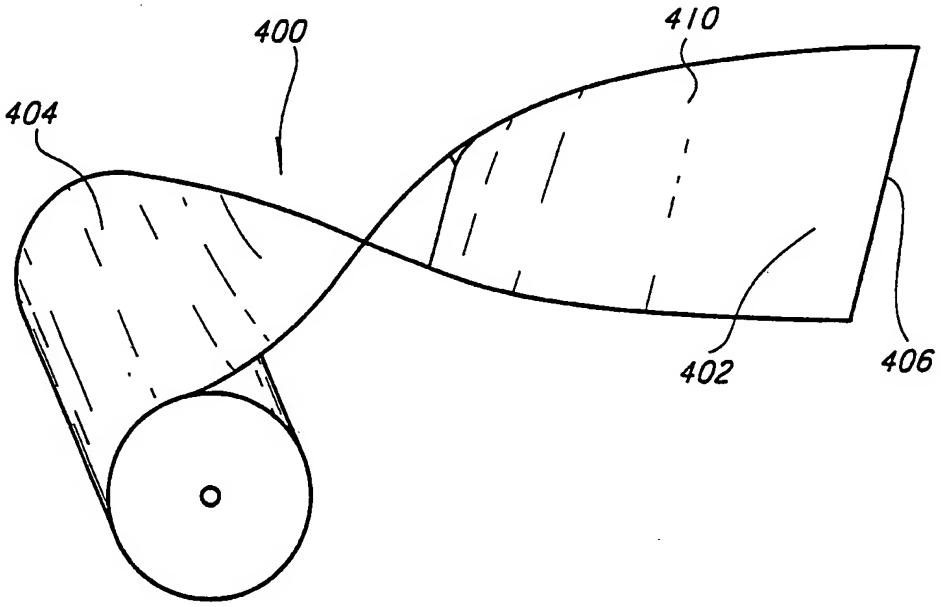

(57) Abstract

A method and apparatus for cleaning a thermal printhead (80) in a thermal printer (20). A roll of a print medium (400) or a thermal transfer ribbon, depending upon the application of the printer, is provided with a web of a cleaning material (410, 411) which is used to clean the printhead by light abrasion. The web of material can be located at the beginning or end of a roll of the print medium or thermal transfer ribbon. In another embodiment, webs of the cleaning material (410a, 410b, 410c) are located periodically throughout the roll of print medium. In a further embodiment, the web of material (400″) is supplied in a roll formed exclusively of the cleaning material.

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Description

METHOD AND APPARATUS FOR CLEANING A THERMAL PRINTHEAD

Technical Field

The present invention relates to printheads for thermal printers, and more particularly, to a method and apparatus for cleaning thermal printheads.

Background of the Invention

Thermal printers create images from elements printed on a thermally sensitive print medium when the print medium passes adjacent to local hot spots on a thermal printhead. In direct thermal printers, the print medium is a temperature-sensitive paper which passes by the printhead in intimate contact with an electrically resistive print bead on the printhead. In thermal transfer printers, the image is transferred from a thermal transfer ribbon carrying a waxy ink to the print medium, the thermal transfer ribbon passing by the printhead in intimate contact with the thermal printhead. For both types of printer, passage of the temperature-sensitive paper or the thermal transfer ribbon past the printhead causes an accumulation of a residue from the paper or ribbon on the thermal printhead. This affects the ability of the thermal printhead to transfer heat to the paper or the ribbon and, consequently, diminishes the quality of the image transferred from the printhead to the print medium.

Those local areas of a printhead which are incapable of heating the print medium sufficiently to create a mark are affected in other ways. The resistance of the thermal bead in the local areas is changed sufficiently to cause a significant rise in power dissipation there. This, in turn, can cause the resistance of the printhead's thermal bead to change,

i.e., to decrease, which is sufficient to change the size of printed elements, such as the printed elements of a bar code symbol.

Summary of the Invention

According to one aspect, the invention is an apparatus for cleaning a thermal printhead. The apparatus comprises a continuous length of material with a first side thereof positionable toward and in close proximity with the printhead as the continuous length of material passes by the printhead during use. A portion of the continuous length of material located on the first side thereof is in contact with the printhead during use and is adapted to clean the printhead as the cleaning portion of the continuous length of material passes by the printhead.

According to another aspect, the invention is a method for cleaning a thermal printhead. The method comprises the steps of (a) positioning a continuous length of material with a first side thereof toward and in close proximity with the printhead as the continuous length of material passes by the printhead during use; and (b) locating a portion of the continuous length of material on the first side thereof in contact with the printhead during use and adapted to clean the printhead as the cleaning portion of the continuous length of material passes by the printhead.

Brief Description of the Drawings

Figure 1 is a perspective view of a thermal printer.

Figure 2 is a side elevational view of a print medium drive mechanism of the thermal printer of Figure 1.

Figure 3 is an electrical schematic of a printhead in a thermal printer.

Figure 4A is a first portion of an electrical schematic diagram of a thermal printer according to the preferred embodiment.

Figure 4B is a second portion of an electrical schematic diagram of a thermal printer according to the preferred embodiment.

Figure 4C is a third portion of an electrical schematic diagram of a thermal printer according to the preferred embodiment.

Figure 5 is an isometric view of a thermal printhead.

Figure 6 is a closeup plan view of the vicinity of the print bead of the thermal printhead of Figure 5.

Figure 7 is a fragmentary cross-sectional view of the printhead of Figure 6, taken along section 7-7.

Figure 8 is a fragmentary cross-sectional view of the printhead of Figure 6, taken along section 8-8.

Figure 9 is a fragmentary cross-sectional view of the printhead of Figure 6, taken along section 9-9.

Figure 10 is a schematic diagram of a roll of a print medium for use with a thermal printhead, the roll of the print medium including a leading section comprising a web of material for cleaning the printhead.

Figure 10A is a schematic diagram of a roll of a print medium for use with a thermal printhead, the roll of the print medium including a trailing section comprising a web of material for cleaning the printhead.

Figure 11 is a schematic diagram of a roll of a print medium for use with a thermal printhead, the roll of the print medium including periodic sections of a web of material for cleaning the printhead.

Figure 12 is a schematic diagram of a roll of a web of material for cleaning the printhead.

Detailed Description of the Invention

Figure 1 is a perspective view of a thermal printer. The thermal printer 20 includes a first housing 22 and a second housing 24. The first housing 22 encloses electrical components, such as electrical motors used in the operation of the thermal printer 20. The first

housing 22 also includes a control panel 26 which allows the thermal printer 20 to be controlled and adjusted by a user.

The control panel 26 includes a liquid crystal display (LCD) 28, a plurality of buttons 30, and a plurality of light emitting diodes (LEDs) 32. The LCD 28 provides an alphanumeric display of various commands useful for the user to control and adjust the thermal printer 20. The buttons 30 implement the user's choices of controls and adjustments, and the LEDs 32 provide displays of the status of the thermal printer 20. For example, one of the buttons 30 can be used to toggle the thermal printer 20 on- and off-line, with one of the LEDs 32 indicating when the printer is on-line. Another one of the buttons 30 can be used to select an array of menus that can be displayed in the LCD 28. These means can include choices of print speeds and media types, among other choices. Still another one of the buttons 30 can be used to reload or advance the print medium through the thermal printer 20. Yet another button 30 can be used to open the printer in order to change the print medium.

The second housing 24 includes a printer module 34 and a motor drive module 36 which are normally latched together. The printer module 34 and the motor drive module 36 are separated by a print medium path 38. By activating another one of the buttons 30, the printer module 34 can be caused to unlatch from the motor drive module 36 and rotate backwards, in a clockwise direction as seen in the view of Figure 1. This action opens the print medium path 38 and allows the adjustment and replacement of the print medium which is introduced into the print medium path 38 from the print medium roll 40. The print medium supplied on the print medium roll 40 is available in a variety of thicknesses, thermal sensitivities, and materials, depending upon the use to be made of the print medium. The print medium supplied from the print medium roll 40 passes through the print medium

path 38 and exits through the opening 42. If the print medium is a thermal transfer medium, a thermal transfer ribbon is placed in a separate drive mechanism contained within the printer module 34. This separate drive mechanism provides supply and take-up rolls for the thermal transfer ribbon, the rolls being separately controllable from the movement of the print medium. This permits saving the thermal transfer ribbon when the pattern to be printed on the print medium contains areas where no printing is required. The motor drive module 36 also contains a cooling fan (not shown) which exhausts air through the grill 44.

Figure 2 is an elevational view of a print medium drive mechanism of the thermal printer of Figure 1. The print medium drive mechanism includes a platen roller 46 placed near the position of the opening 42, shown in Figure 1. The print medium from the print medium roll 40 passes through the print medium path 38 with its printed side facing up. The print medium is advanced through the print medium path 38 by an advancement mechanism and forced to pass between the platen roller 46 and a thermal printhead 80 which is located near the opening 42.

When the printer module 34 is locked in position against the motor drive module 36, the print medium is forced against the printhead 80 by the platen roller 46. In order to accommodate a wide variety of printer media, the pressure between the platen roller 46 and the printhead 80 is variably adjustable.

The printhead 80 rotates about the shaft 82, to one end of which is affixed the arm 84. Accordingly, clockwise movements of the arm 84 about the shaft 82 cause the printhead 80 to move toward the platen roller 46. If the printhead 80 is moved so that it is engaged against a print medium passing between the platen roller 46 and the printhead 80, further clockwise movements of the arm 84 about the shaft 82 will cause the pressure of the printhead 80 against the print medium to increase.

Figure 3 is an electrical schematic of a printhead in a thermal printer. The printhead 80 comprises a linear array of small, closely spaced resistive print elements 102_1-102_a. One end of each of the resistive print elements 102_i is connected to an electrical common line which is maintained at a voltage above ground by a capacitor 104. Preferably, capacitor 104 is a 10MF, 50 volt capacitor. The other end of each of the resistive print elements 102_i is connected to an AND gate 106_i. Each of the AND gates 106_i receives two signals. One of the signals is a strobe signal and the other is a data signal transferred from a latch 108.

In one particular preferred embodiment, the resistive print elements 102_i can be grouped into a number of adjacent groups of print elements, each group occupying a particular region of the thermal printhead 80. This allows each group of print elements to receive an independently generated strobe signal, which can differ from the strobe signals transmitted to the other groups of print elements. For example, if the printhead 80 includes 896 print elements, it can be divided into four independently-driven regions, the first region including 128 print elements and the remaining three regions each including 256 print elements. However, in another preferred embodiment, the same strobe signal is transmitted to each AND gate 106_i. The signals representing the data contained in the latch 108 are imposed on one leg of each corresponding AND gate 106_i, beginning at a time specified by the latch (LA) signal. This arrangement permits each of the AND gates 106_i to receive its corresponding data at the same time as all of the other AND gates 106_i.

The data stored in the latch 108 are transferred from a number of shift registers 110_1-110_n. The number of shift registers 110_i corresponds to the groups of print elements discussed previously. Therefore, in the first preferred embodiment discussed above, $n = 4$. Each of the

a halt, which is signified to the print engine microprocessor 208 by the respective encoders.

The image microprocessor 216 also shares information with the ROM 230 and an image RAM 232 on a bidirectional line. The ROM 230 contains programs and used by the image microprocessor 216 and data describing invariant signals, such as the selection of strobe signals which may be used by the print engine microprocessor in a method to be described subsequently. The image RAM 232 contains a number of bands of the image to be printed. In addition, the image microprocessor 216 drives the LCD 28 and communicates with the control panel 26 over a bidirectional line. Further, the image microprocessor 216 communicates over a bidirectional line with the memory expansion interface 234, which has provisions for adding more RAM and ROM to the image microcomputer I/O 204. The image microprocessor 216 also communicates with the I/O option interface 236 over a bidirectional line. The interface 236 allows communications between the image microprocessor 216 and a mainframe computer. This data link can be used to load data to a mainframe computer for further processing, or to load data from a mainframe computer to the image microprocessor 216, such as data for the image RAM 232. Beyond these communication links, the image microprocessor 216 can also communicate with a serial interface 238 over a bidirectional line. This link will also allow the transfer of data in and out of the image microprocessor 216, but will also allow the image microprocessor 216 to be reprogrammed. Finally, the image microprocessor 216 also communicates with an image buffer 240 over a unidirectional bus and receives an interrupt signal from the image buffer 240 over a unidirectional line. The image buffer transfers images the image microprocessor 216 has retrieved from the image RAM 232 to a history RAM 242 in a thermal controller 244. The thermal controller, which produces the signals used to define the thermal images to be printed by the printhead

80, also includes a state machine 246 and a table RAM 248. The state machine 246 produces timing signals needed by the thermal controller 244, under the influence of signals produced by the output interface 214, which is connected to the print engine microprocessor 208. The table RAM 248 is loaded with a table from the ROM 210 in the print engine microcomputer 202 by the print engine microprocessor 208 through the output interface 214. The table RAM 248 receives timing signals from the state machine 246 and the history RAM 242. These signals point to a particular entry in the table RAM 248, depending upon the history of the current print element as designated by the image sent by the image buffer 240 to history RAM 242. The data produced from the table RAM 248 are sent over data lines to the data registers 110_i in the printhead 80. The thermal controller also produces the clock signal which provides proper timing to the registers 110_i. The latch and strobe signals are respectively sent to the latch 108 and drivers 106_i by the output interface 214, which receives its input from the print engine microprocessor 208, as described previously. The latch signal is produced by the state machine 246.

Figure 5 is an isometric view of a thermal printhead. The printhead 80 is built on a substrate 312, preferably, but not necessarily, made from a ceramic material and consisting primarily of a print bead 314, associated electronics 200 (see Figure 4A-C), and an electrically conductive printhead driver cover 318. Driver cover 318 is spring loaded in reaction to the forces imposed by retaining screws 320 to maintain electrical contact with upper surface 322. Cover 318 is connected to electrical ground through grounding conductor 324. Electrical conductor 326 connects grounded cover 318 to points in electronics 200 that should be grounded. In particular, grounding strap 328 is grounded through electrical conductor 326. The electronics 200 is connected to shift serially received data across the

linear array of drivers that control individual printer elements created along a print bead 314.

After the data have been serially loaded into the individual print element drivers through electrical connector 330, the circuitry receives a strobe pulse which causes the individual print elements to heat or not to heat, depending upon whether a 1 or a 0 has been loaded into the corresponding driver.

Print bead 314 creates transverse lines on the temperature-sensitive media as the media passes, in intimate contact with print bead 314, from right to left over printhead 80. The printing medium is incrementally driven by a stepper motor, the increments being substantially equal to the width of the line created by print bead 314. This allows solid characters to be created by printhead 80.

Figure 6 is a closeup plan view of the vicinity of print bead 314 of thermal printhead 80. Print bead 314 is a continuous linear bump that rises above the general level of upper surface 322 of printhead 80 (see Figure 5). Print bead 314 is defined by the deposition of a thin, linear strip of resistive material which heats when it receives electrical current. The structure of print bead 314 will be shown in greater detail subsequently. Returning to Figure 6, print bead 314 lies over and comes into contact with one or more first conductive leads 340 and one or more second conductive leads 342. First and second conductive leads 340 and 342 are uniformly interdigitated under print bead 314, the width of the conductive leads 340 and 342 themselves being substantially smaller than the center-to-center spacing. First conductive leads 340, which can serve as anode leads, are held at a predetermined supply voltage through their connection to conductor 344, upon which supply voltage is imposed. Second conductive leads 342 can be grounded or not through the electronics 200 (in Figures 4A-C). If a particular second conductive lead, which may

be a cathode lead, is grounded, a conductive path is completed between the grounded second conductive leads 342 and the two adjacent first conductive leads 340, permitting the passage of electric current between them through print bead 314. The resulting conducted current causes the local portion of print bead 314 surrounding the grounded second conductive lead 342 to heat, thereby creating a small rectangular dot whose transverse extent equals the center-to-center separation between first conductive leads 340. If, on the other hand, a second conductive lead 342 is not grounded, the local area surrounding the second conductive lead 342 will not heat and a black dot will not be created thereby.

In the current implementation, the electrical resistance of a single linear print element is approximately 250 ohms. When appropriately grounded through a second conductive lead 342, a typical print element experiences a temperature rise of approximately 300°C above its ambient temperature of 50°C in less than two milliseconds, the period of time for which a second conductive lead 342 is grounded. When second conductive lead 342 is disconnected from ground, the print element returns to ambient temperature.

Figure 7 is a fragmentary cross-sectional view of the printhead 80 of Figure 6, taken along section 7-7. The structure in the vicinity of print bead 314 is created over substrate 312. The structure can consist of an anode supply sheet conductor 352 formed on the surface of substrate 312. Sheet conductor 352 is connected to a source of the anode voltage and will be discussed in greater detail subsequently. Glass underglaze 354 is formed over sheet conductor 352 and serves to electrically insulate sheet conductor 352 from the layers formed over glass underglaze 354 in those areas where such insulation is desired. Along section 7-7 of Figure 6, a portion of glass underglaze 354 is covered by second conductor lead 342, which extends under and makes electrical contact with

the semicircular form of resistive element 356. Another portion of glass underglaze 354 is overlaid by glass overglaze 358. Depending upon the manufacturing tolerances in the placement of resistive element 356 with respect to the end of second conductive lead 342, resistive element 356 can either contact glass underglaze 354 or lie entirely over second conductive lead 342. Glass overglaze 358 covers the resistive element 356 and a portion of second conductor lead 342 in the vicinity of the electrical connection between second conductive lead 342 and resistive element 356. If desired, glass overglaze 358 can cover substantially all of second conductive lead 342.

Figure 8 is a fragmentary cross-sectional view of the printhead 80 of Figure 6, taken along section 8-8. The printhead is formed over substrate 312 and anode supply sheet conductor 352, which can be a thin layer of gold, and extends to an edge 346 of printhead 80 (see Figure 5). Glass underglaze 354 is formed over the surface of sheet conductor 352, but does not extend to edge 346. Conductor 344, which is typically made from the same material as sheet conductor 352, extends from edge 346 back toward resistive element 356 of print bead 314 and overlapping glass underglaze 354. Along section 8-8 of Figure 6, there are no conductor leads making contact with resistive element 356. Therefore, after resistive element 356 has been formed on glass underglaze 354, glass overglaze 358 covers resistive element 356 and at least some surrounding portions of glass underglaze 354.

The thermal printhead structure defined up to this point in connection with Figures 7 and 8 is a typical thermal printhead structure. Such a printhead can be purchased from Rohm Company. Other specific forms of thermal printheads are also available using a thermally conductive, electrically insulative overglaze.

In some embodiments, there is an additional conductive layer formed over the printhead structure

defined so far. The surface of glass overglaze 358 is typically passivated. Therefore, in order to ensure that the electrically conductive surface layer to be created will adhere adequately, activating primer layer 360, which may consist of a layer of aluminum oxide (Al_2O_3) or titanium dioxide (TiO_2), is deposited over glass overglaze 358. Activating primer layer 360 is then coated with electrically conducting outer layer 362, which may, by way of example, be a 100-Angstrom-thick layer of chromium. Activating primer layer 360 is found to perform adequately when it has thicknesses in the range of 10 to 100 Angstroms, with a 10-Angstrom layer resulting in excellent thermal transfer from the resistive element through the conducting outer layer 362 to the printing medium.

In some instances, where the direct adherence of conducting outer layer 362 to glass overglaze 358 is found to be adequate, it may not be necessary to form an activating primer layer 360 between the glass overglaze and conducting outer layers such as shown in Figure 9. In the thermal printhead structure shown in the fragmentary cross-sectional view of Figure 9, which is formed over substrate 312, anode supply sheet conductor 352 is connected with first conductive lead 340 through conductor 344, which is formed adjacent edge 346. Conductors 352 and 344 and conductive lead 340 can be formed, for example, from gold. First conductive lead 340 is supported by glass underglaze 354, which is formed over sheet conductor 352, but does not extend fully to edge 346. The upper surface of first conductive lead 340 is covered by glass overglaze 358 and then by conducting outer layer 362.

Static electricity generated by the passage of the print medium over printhead 80 is dissipated by conducting outer layer 362, which is electrically grounded. One method for providing such grounding is shown in Figure 5, where conducting outer layer 362 is intimately contacted by a spring-loaded edge 364 of

Through the output interface 214, the print engine microprocessor 208 sends the signals to a ribbon take-up drive 218, a ribbon supply drive 220, a stepper motor drive 222, and a head motor drive 224. The stepper motor drive 222 produces appropriate drive signals and transmits them to the stepper motor 50. The head motor drive 224 also produces appropriate signals and sends them to the head motor 150. Movements of the print medium caused by the stepper motor 50 are sensed by the sensor 226 which produces signals that are transmitted to the input interface 212. Movements of the printhead 80 by the head motor 150 are monitored by two sensors, the optical caliper detector 114 and a print module position sensor 228. The optical caliper detector 114 transmits signals to the input interface 212, indicating whether the printhead 80 is in the print mode or the idle mode. The print module position sensor 228 transmits a signal which indicates whether the printer module 34 is disengaged from the motor drive module 36.

The ribbon take-up and ribbon supply drives operate similarly to one another. Each of them receives signals from the output interface 214 and produce signals which drive the ribbon take-up and supply motors, respectively. Under command from the print engine microprocessor they facilitate movements of the thermal transfer ribbon in the print module 34, if a thermal transfer medium is being used. The two ribbon motors are monitored by encoders which send signals to the input interface 212. These signals can be used by the print engine microprocessor 208 in case of a ribbon jam or break. The ribbon take-up and supply drives also operate to balance the torques in their two respective rolls, so that the ribbon moves smoothly, at the same speed as the print medium, without wrinkling or breaking. In addition, in case the print engine microprocessor 208 declares a print save mode, the two ribbon drives bring the ribbon to

shift registers 110_i receives data from a separate input data line (DIi). The data are shifted into the consecutive stages of the shift register 110_1 at times governed by the clock pulse (CP) signal. If desired, the data in each shift register 110_i can be cycled out on the data out line (DOi). The voltage on the logic elements of the printhead 80 (i.e., the latch 108 and the shift registers 110_i) is maintained by the capacitor 111. The printhead 80 also includes a thermistor 112 which produces a signal indicative of the temperature of the printhead 80.

Figures 4A-C comprise an electronics schematic diagram. The electronics 200 includes two microcomputers, a print engine microcomputer 202 and an image microcomputer 204. The print engine microcomputer 202 is primarily responsible for controlling the movement of the print medium and the thermal transfer ribbon (if any) through the printer path and supplying print timing commands to the printhead 80. The image microcomputer 204 produces the images which are to be printed on the print medium. The print engine microcomputer 202 includes a print engine microprocessor 208, a read-only memory (ROM) 210, an input interface 212, and an output interface 214. The ROM 210 communicates with the print engine microprocessor 208 over bidirectional lines. The input interface 212 transmits signals to the print engine microprocessor 208 and the print engine microprocessor 208 transmits signals to the output interface 214.

The image microcomputer 204 includes an image microprocessor 216. The print engine microprocessor 208 and the image microprocessor 216 both communicate over bidirectional lines with a shared random access memory 206. In addition, the print engine microprocessor 208 can communicate interrupt signals to the image microprocessor 216 and the image microprocessor 216 can communicate interrupt signals to the print engine microprocessor 208.

conductive printhead driver cover 318. Cover 318 is grounded through grounding conductor 324. Other methods for grounding conducting outer layer 362 will, of course, be apparent to one skilled in the art.

In practice, it has been found that print bead 314 can be spaced approximately 100 mils behind edge 346 of printhead 80 (see Figure 5). It has also been found that the edge of conducting outer layer 362 can be separated from edge 346 by approximately 50 mils. This spacing results in the avoidance of unintentional short circuits between conducting outer layer 362 and conductor 344. Similar spacing should be maintained around any exposed electrical connections.

In operation, the printhead 80 comes into intimate contact with very long rolls of either print medium (in the case of a thermally-sensitive medium) or thermal transfer ribbon. This results in an accumulation of a residue of either paper fibers and other materials from the print medium or the thermal transfer wax used in the thermal transfer ribbons and any dirt which may accumulate thereon. This material acts as a thermal insulator which prevents the desired transfer of thermal energy from the thermal printhead 80 to the print medium or thermal transfer ribbon, as the case may be. As has been described above, this will possibly promote both a degraded image and a premature failure of the printhead 80.

Figure 10 is a schematic diagram of a roll 400 of a thermally-sensitive print medium for use with a thermal printhead, the roll of the print medium including a leading section comprising a web of material for cleaning the printhead. Figure 10A is a schematic diagram of a roll of a print medium for use with a thermal printhead, the roll of the print medium including a trailing section comprising a web of material for cleaning the printhead. The roll 400 has a first side 402 and a second side 404. The first side 402 passes adjacent the

printhead 80 when it is in use in a thermal printer. The roll 400 also has a leading first end 406 and a trailing second end 407. The first end 406 is the first portion of the roll 400 to pass by the printhead 80 in the printer. It has a leading portion 410 made from a web of material which is capable of cleaning the printhead 80. The trailing second end 407 of the roll 400 is the last portion of the roll 400 to pass by the printhead 80 in the printer. It has a trailing portion 411 made from a web of material which is capable of cleaning the printhead 80.

It has been determined experimentally that a paper stock, such as Strathmore Bean Brilliant 65# Cover is suitable for this purpose. This paper has a paper smoothness between about 420 and 435 Sheffield units, and paper smoothness of the order of 400 to 450 Sheffield units has been found to be suitable. It has also been determined that the first side 402 of the web of material, which contacts the printhead 80, should contain absorbent fillers, such as titanium, calcium, silicon, or urea-based particles. These particles are usually white, may be crystalline, are hard, and have a large surface area. The topcoat abrades the residue from the printhead 80.

Figure 11 is a schematic diagram of a roll 400′ of a print medium for use with a thermal printhead. The roll 400′ of the print medium includes lengthwise spaced apart sections 410a, 410b, 410c, et cetera, of a web of material for cleaning the printhead. The roll 400′ shown in Figure 11 is particularly suitable for use with label stock with regularly placed label portions 412. The sections 410a, 410b, 410c, ..., are placed between the regularly placed label portions 412. This allows the printhead 80 to cleaned regularly during use.

Although the foregoing description of the rolls 400 and 400′ have described a roll containing a print medium, the roll can alternatively contain a thermal transfer ribbon, in case the printer is used as a thermal transfer printer.

Figure 12 is a schematic diagram of a roll 400" of a web of material for cleaning the printhead 80. In this case, the entire roll 400" can be used to clean the printhead 80. It may be used as a part of a regular preventive maintenance program, such as after each complete use of a roll of print medium. It may also, of course, be used whenever the printhead 80 is determined to be in need of cleaning.

While the foregoing detailed description has described several preferred embodiments of the present invention, it will be apparent to those skilled in the art that various modifications of the present invention can be made without departing from its scope and spirit, which is to be limited only by the following claims.

Claims

1. A web of material for cleaning a printhead that transfers an image from the printhead to one side of a print medium as the print medium passes in close proximity to the printhead, comprising:

a portion of the web of material located on the same side of the web of material as the side of the print medium to which the image is transferred by the printhead, the portion of the web of material being adapted to clean the printhead as the web of material passes adjacent to the printhead.

2. The web of material of claim 1, where the web of material has a first end which passes adjacent to the printhead before any other portion of the web of material, the one side of the first end of the web of material being comprised in the portion adapted to clean the printhead.

3. The web of material of claim 2, where the web of material further comprises a second end which passes adjacent to the printhead after any other portion of the web of material, the one side of the second end of the web of material being comprised in the portion adapted to clean the printhead.

4. The web of material of claim 1, wherein the web of material passes adjacent to the printhead lengthwise, portion of the web of material comprising sections that are placed periodically along the length of the web of material.

5. A web of material for cleaning a printhead that transfers an image from the printhead to one side of a print medium formed in a roll, as the print medium passes in close proximity to the printhead, comprising:

a portion of the web of material located on the same side of the web of material and spliced into the roll of the print medium, the portion of the web of material being adapted

to clean the printhead as the web of material passes adjacent to the printhead.

6. The web of material of claim 5, where the roll of the print medium has a first end which passes adjacent to the printhead before any other portion of the roll of the print medium, the first end of the roll of the print medium being a section of the web of material adapted to clean the printhead.

7. The web of material of claim 6, where the roll of the print medium has a second end which passes adjacent to the printhead after any other portion of the roll of the print medium, the second end of the roll of the print medium being a section of the web of material adapted to clean the printhead.

8. The web of material of claim 5, wherein the web of material passes adjacent to the printhead lengthwise, portion of the web of material comprising sections that are placed periodically along the length of the web of material.

9. The web of material of claim 5, wherein the web of material comprises a thermal transfer ribbon.

10. A printer for transferring an image to one side of a print medium, comprising:

a printhead that transfers the image to the one side of the print medium as the print medium passes in close proximity to the printhead; and

a web of material for cleaning the printhead that, the portion of the web of material being located on the same side of the web of material as the side of the print medium to which the image is transferred by the printhead, the portion of the web of material being adapted to clean the printhead as the web of material passes adjacent to the printhead.

11. The printer of claim 10, where the web of material has a first end which passes adjacent to the printhead before any other portion of the web of material, the one side of the first end of the web of material being comprised in the portion adapted to clean the printhead.

12. The printer of claim 11, where the web of material further comprises a second end which passes adjacent to the printhead after any other portion of the web of material, the one side of the second end of the web of material being comprised in the portion adapted to clean the printhead.

13. The printer of claim 10, wherein the web of material passes adjacent to the printhead lengthwise, portion of the web of material comprising sections that are placed periodically along the length of the web of material.

14. A method for cleaning a printhead that transfers an image from the printhead to one side of a print medium as the print medium passes in close proximity to the printhead, comprising the step of:

forming a web of material, a portion of the web of material located on the same side of the web of material as the side of the print medium to which the image is transferred by the printhead, the portion of the web of material being adapted to clean the printhead as the web of material passes adjacent to the printhead.

15. The method of claim 14, further comprising the step of forming a first end on the web of material, the first end passing adjacent to the printhead before any other portion of the web of material, the one side of the first end of the web of material being comprised in the portion adapted to clean the printhead.

16. The method of claim 15, further comprising the step of forming a second end on the web of material, the second end passing adjacent to the printhead after any other portion of the web of material, the one side of the second end of the web of material being comprised in the portion adapted to clean the printhead.

17. The method of claim 14, further comprising the steps of placing sections of the web of material periodically along the length of the print medium and passing the web of material adjacent to the printhead lengthwise.

18. A method for cleaning a printhead that transfers an image from the printhead to one side of a print medium formed in a roll, as the print medium passes in close proximity to the printhead, comprising the steps of:

locating a portion of the web of material on the same side of the web of material, the portion of the web of material being adapted to clean the printhead as the web of material passes adjacent to the printhead;

splicing the portion of the web of material into the roll of the print medium.

19. The method of claim 18, further comprising the step of forming a first end on the roll of the print medium, the first end passing adjacent to the printhead before any other portion of the roll of the print medium, and the first end of the roll of the print medium being a section of the web of material adapted to clean the printhead.

20. The method of claim 19, further comprising the step of forming a second end on the roll of the print medium, the second end passing adjacent to the printhead after any other portion of the roll of the print medium, the second end of the roll of the print medium being a section of the web of material adapted to clean the printhead.

21. The method of claim 18, further comprising the step of passing the web of material lengthwise adjacent to the printhead, the portion of the web of material comprising sections that are placed periodically along the length of the web of material.

22. The method of claim 21, further comprising the step of forming the web of material in a thermal transfer ribbon.

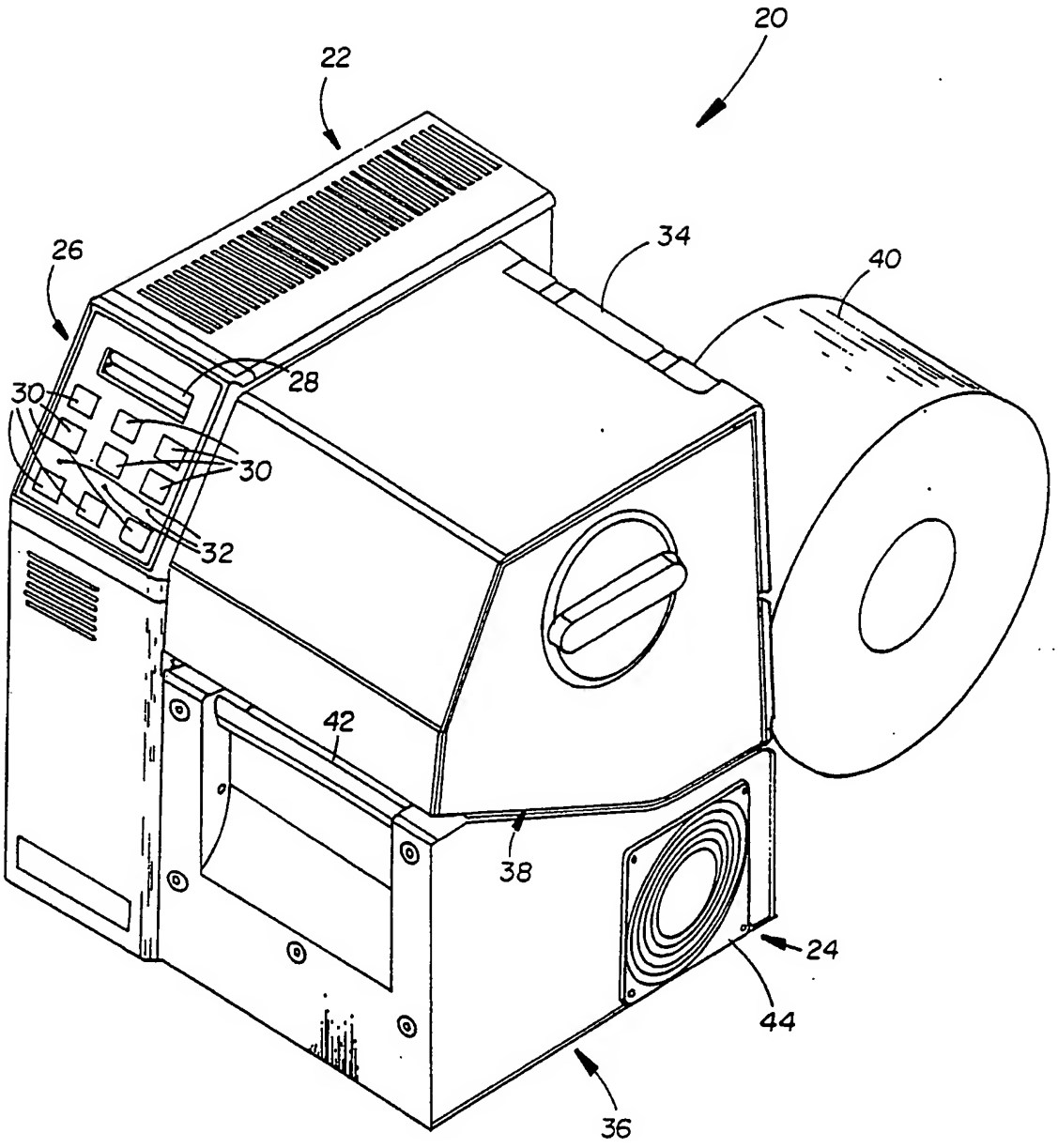


FIG. 1

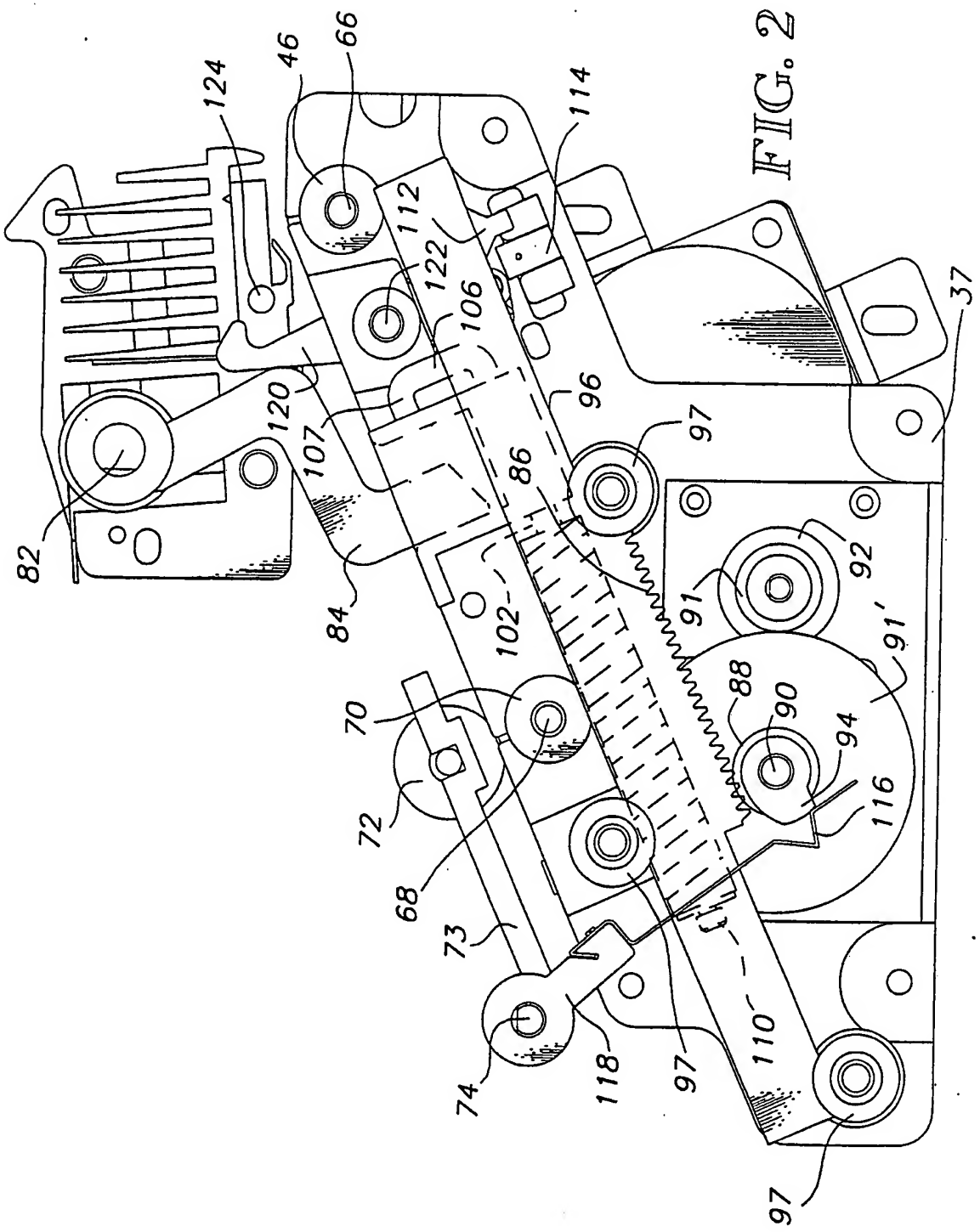
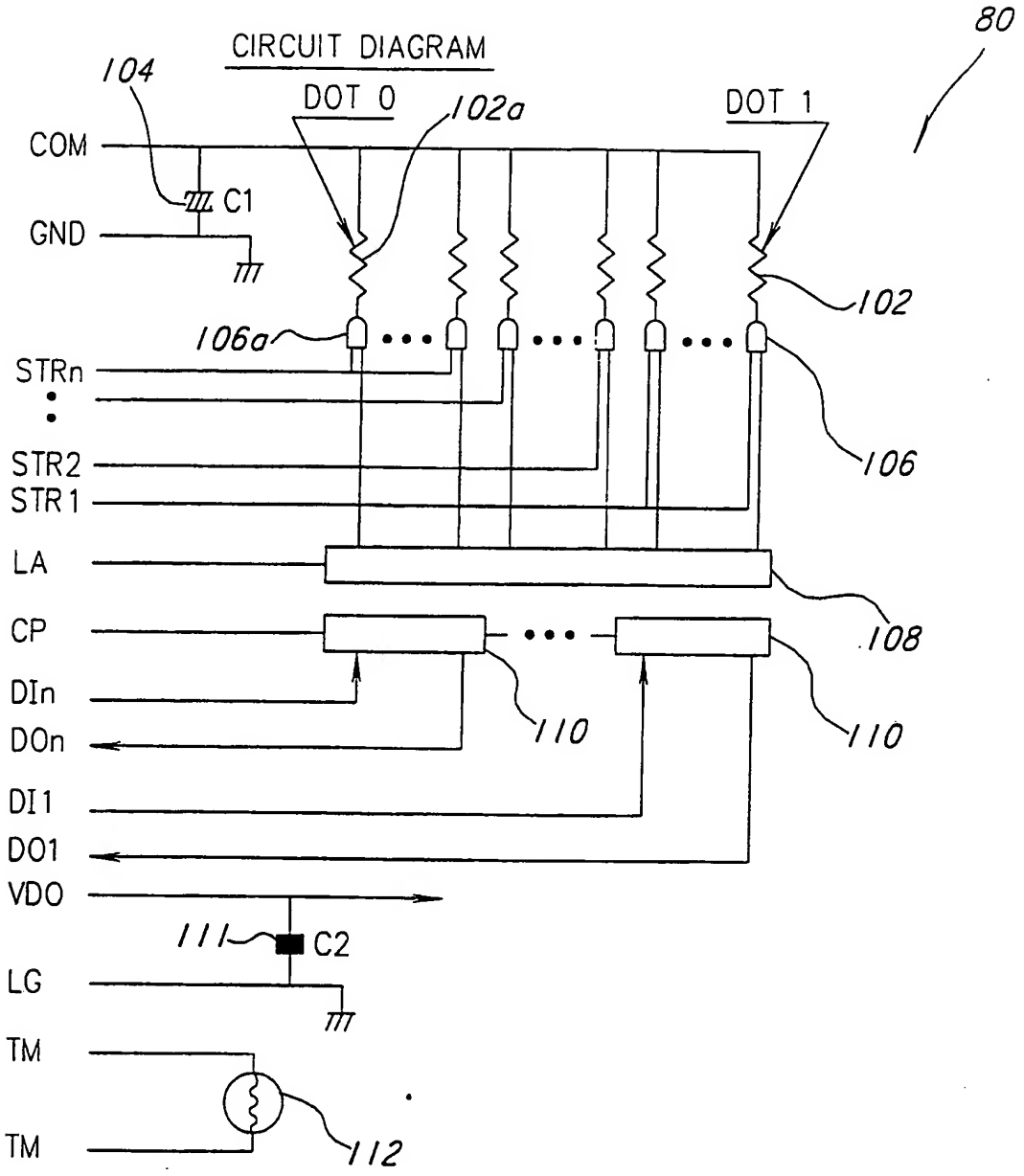

124
46
66
114
112
122
106
120
107
96
97
37
82
84
86
102
91
92
91'
88
90
94
116
70
72
68
73
74
118
97
110
97

FIG. 2



DI, DO, STR: n = 6 DOT: a = 1408 dots

n	DOT No.	dots/STR
1	1 – 123	128
2	123 – 384	256
3	385 – 640	256
4	641 – 896	256
5	897 – 1152	256
6	1153 – 1408	256

FIG. 3

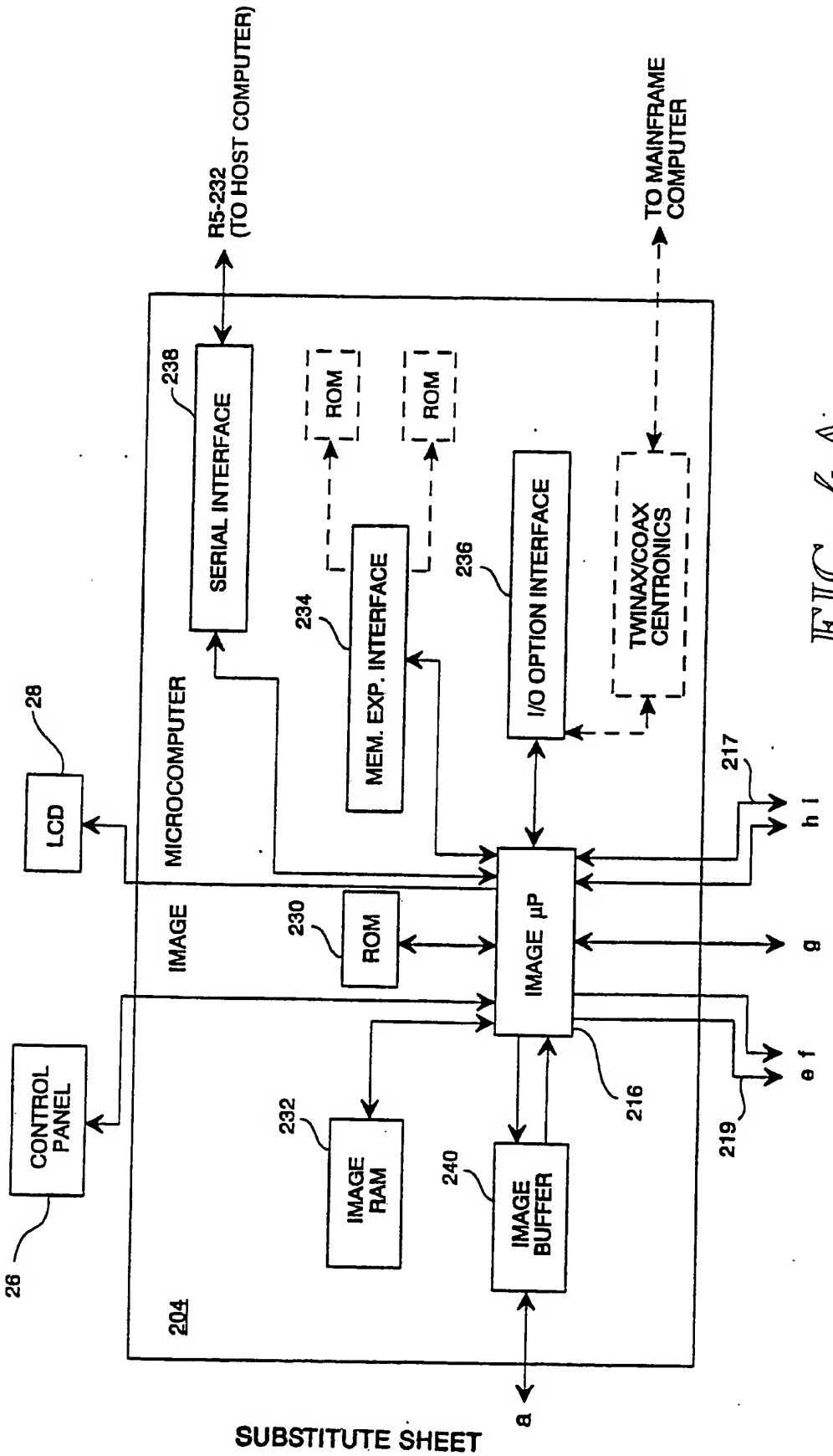

R5-232
(TO HOST COMPUTER)
TO MAINFRAME
COMPUTER
238
SERIAL INTERFACE
ROM
ROM
234
MEM. EXP. INTERFACE
236
I/O OPTION INTERFACE
TWINAX/COAX
CENTRONICS
28
LCD
MICROCOMPUTER
IMAGE
230
ROM
IMAGE µP
217
h i
g
e f
216
219
CONTROL
PANEL
26
232
IMAGE
RAM
240
IMAGE
BUFFER
204
a

FIG. 4A

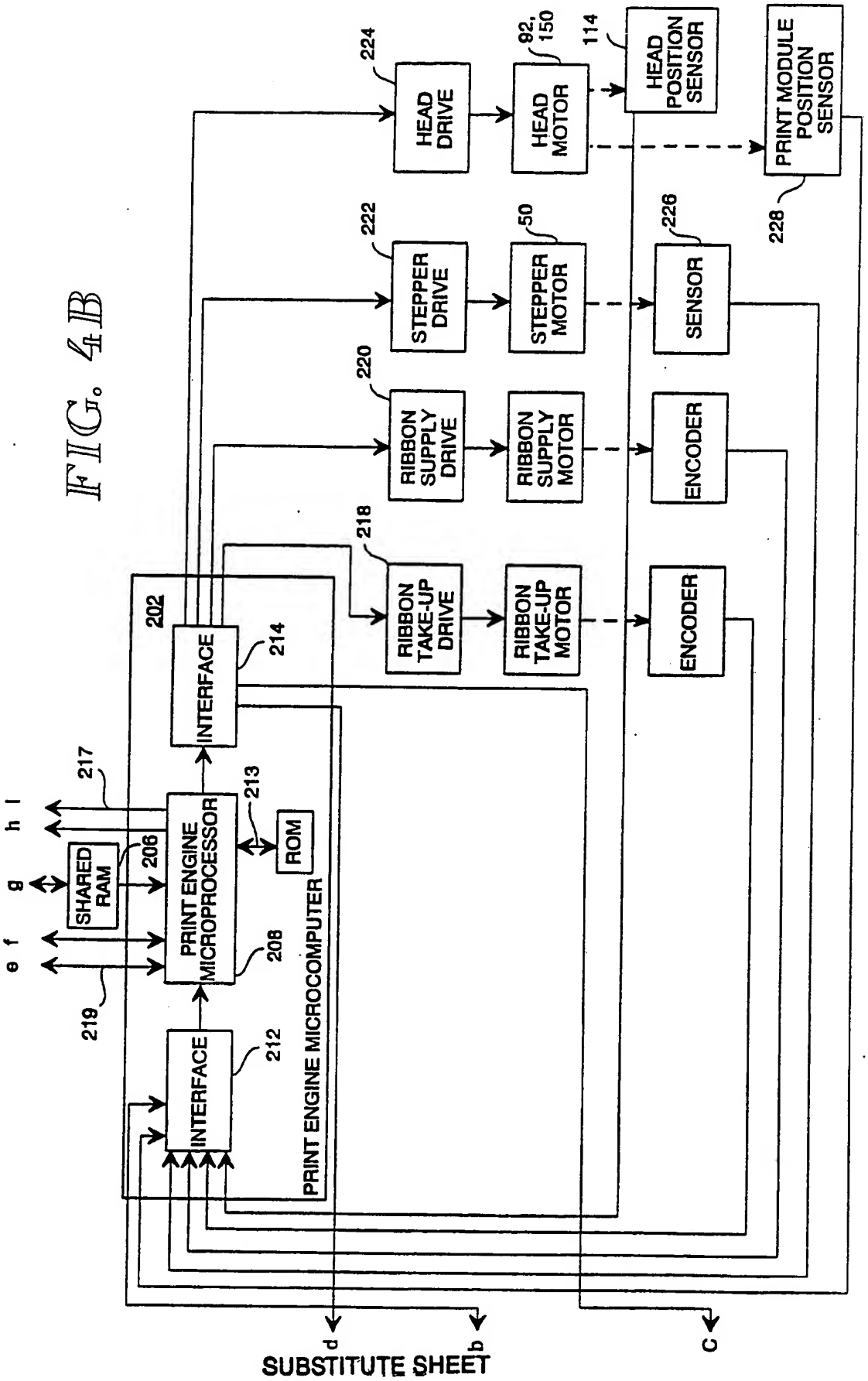

HEAD DRIVE
224
HEAD MOTOR
82, 150
114
HEAD POSITION SENSOR
PRINT MODULE POSITION SENSOR
228
STEPPER DRIVE
222
STEPPER MOTOR
50
SENSOR
226
RIBBON SUPPLY DRIVE
220
RIBBON SUPPLY MOTOR
ENCODER
RIBBON TAKE-UP DRIVE
218
RIBBON TAKE-UP MOTOR
ENCODER
202
INTERFACE
214
217
213
SHARED RAM
206
PRINT ENGINE MICROPROCESSOR
ROM
208
219
INTERFACE
212
PRINT ENGINE MICROCOMPUTER
e f g h i
d
b
c

FIG. 4B

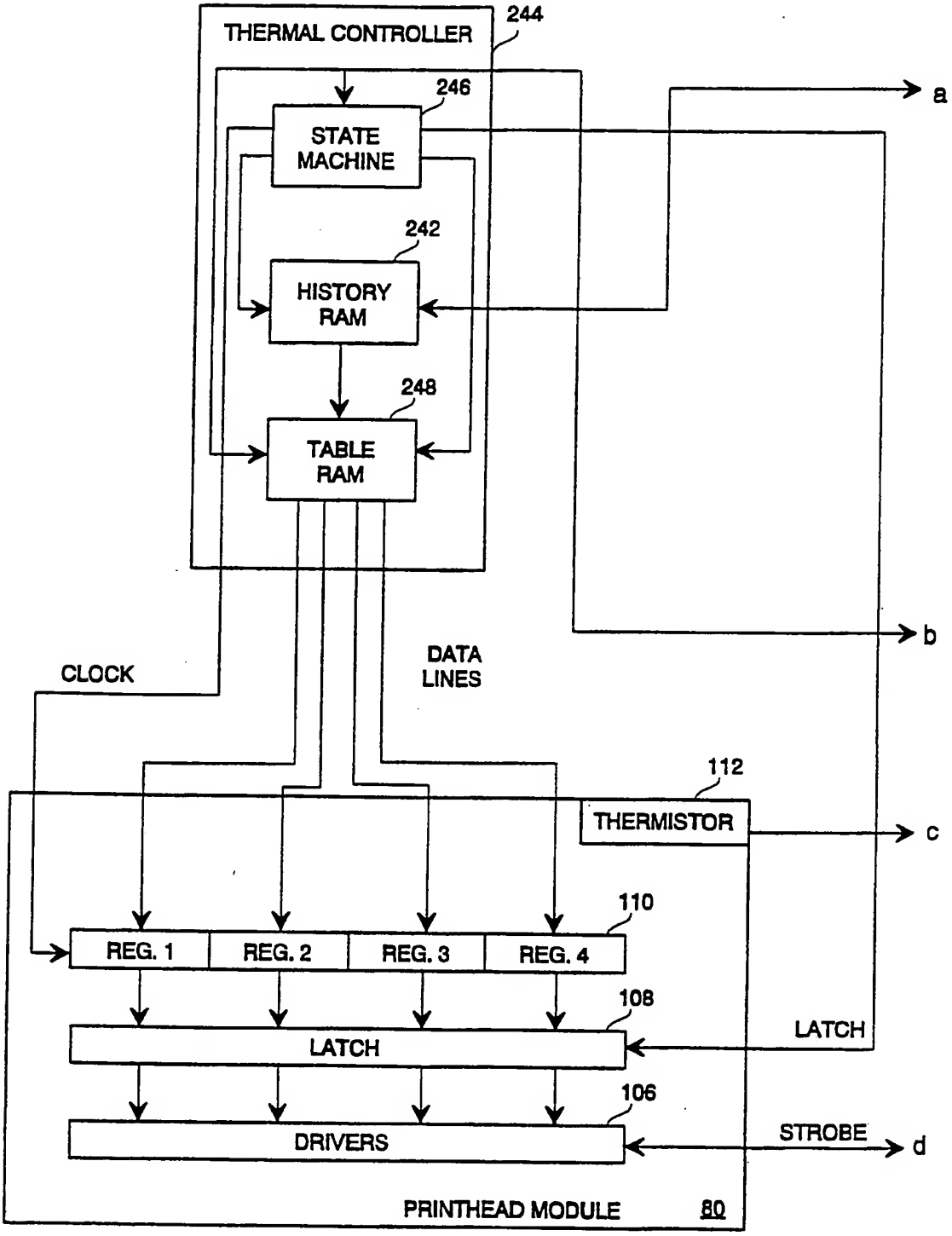

THERMAL CONTROLLER
244
246
STATE MACHINE
242
HISTORY RAM
248
TABLE RAM
a
b
c
d
CLOCK
DATA LINES
112
THERMISTOR
110
REG. 1
REG. 2
REG. 3
REG. 4
108
LATCH
LATCH
106
DRIVERS
STROBE
PRINTHEAD MODULE
80

FIG. 4C

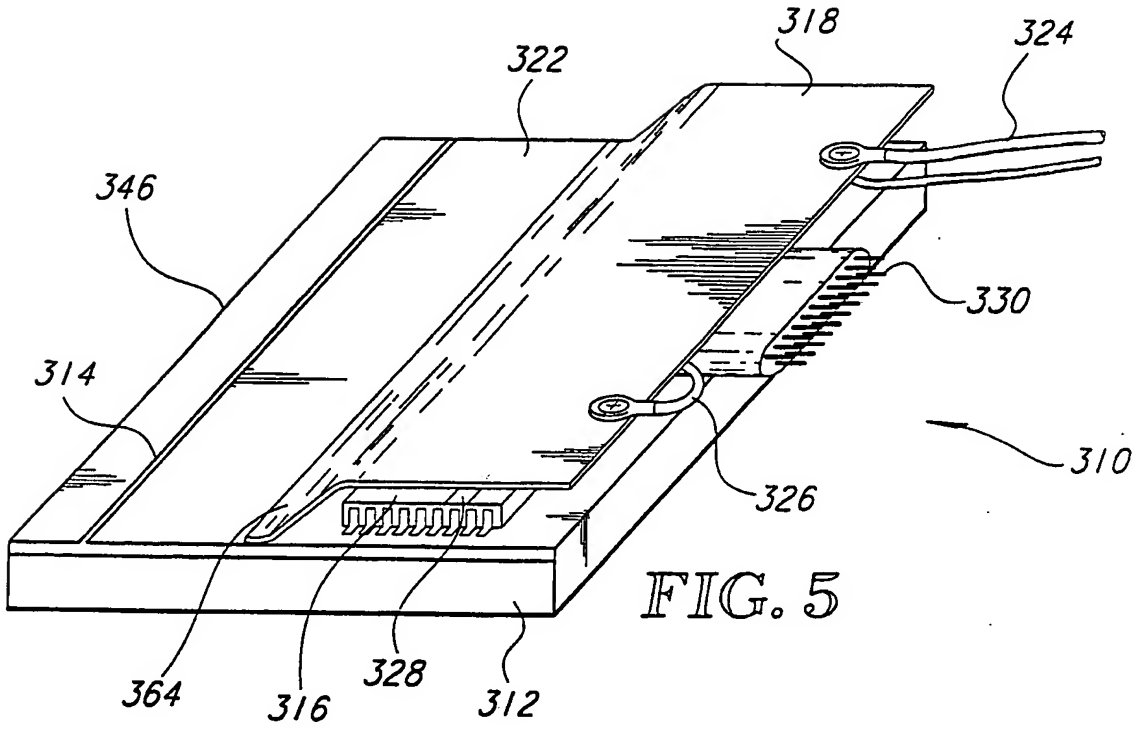

318
324
322
346
330
314
310
326
364
316
328
312

FIG. 5

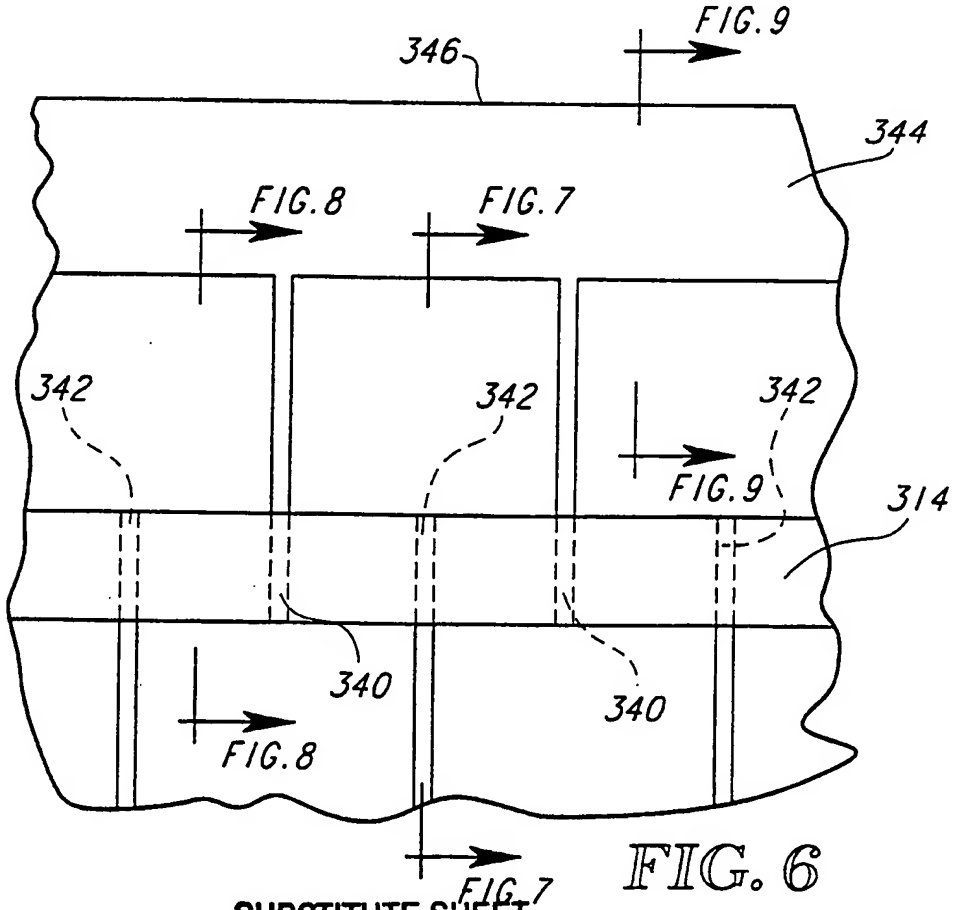


FIG. 9
346
344
FIG. 8
FIG. 7
342
342
342
FIG. 9
314
340
340
FIG. 8
FIG. 7

FIG. 6

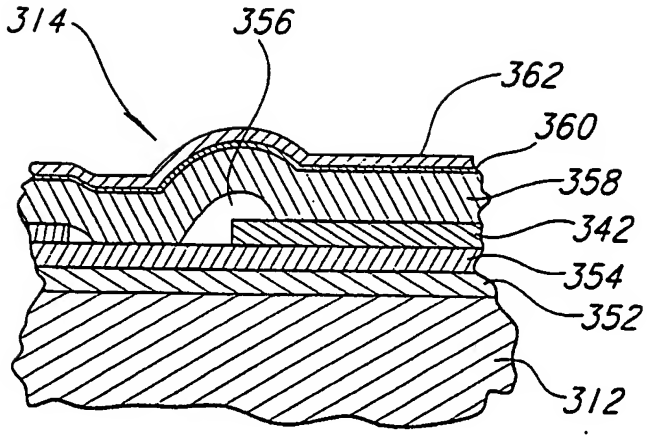


FIG. 7

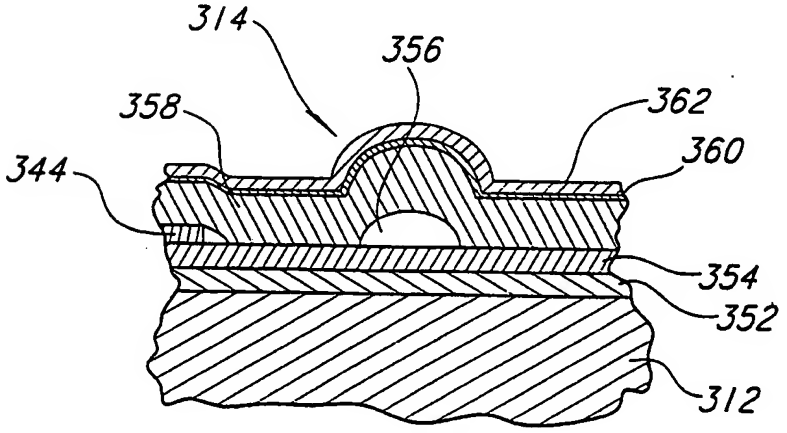


FIG. 8

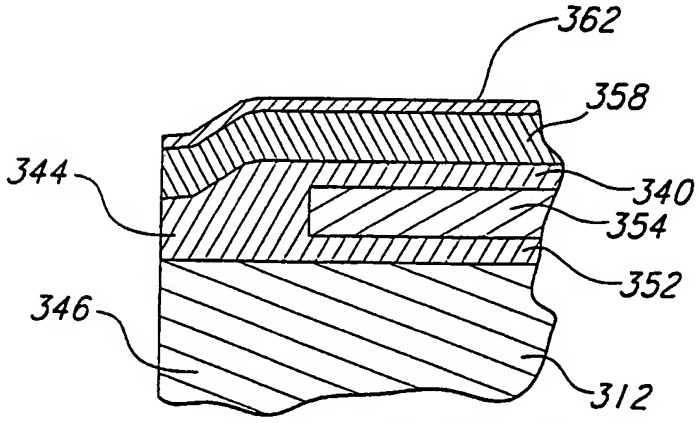


FIG. 9

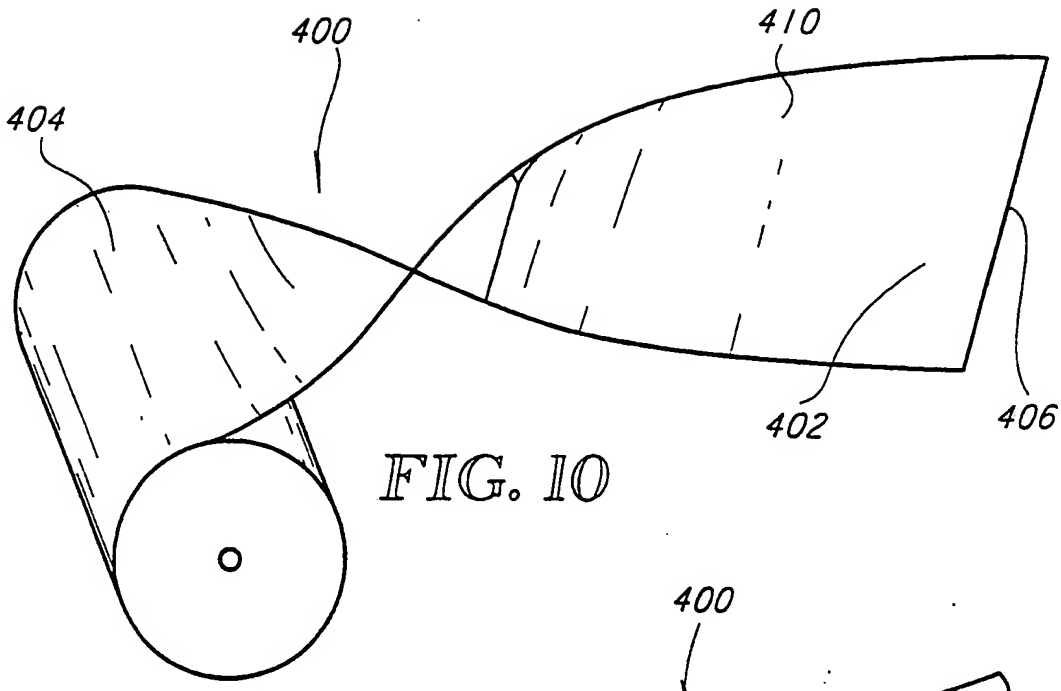


FIG. 10

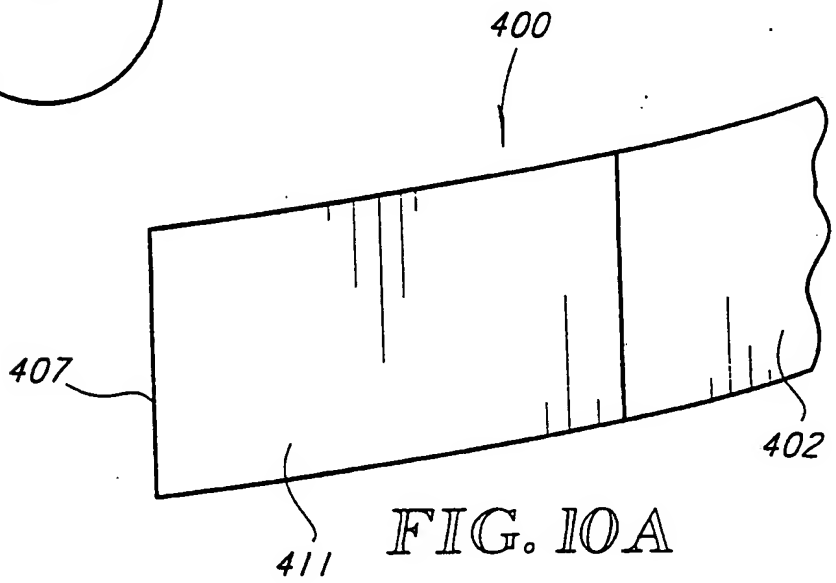


FIG. 10A

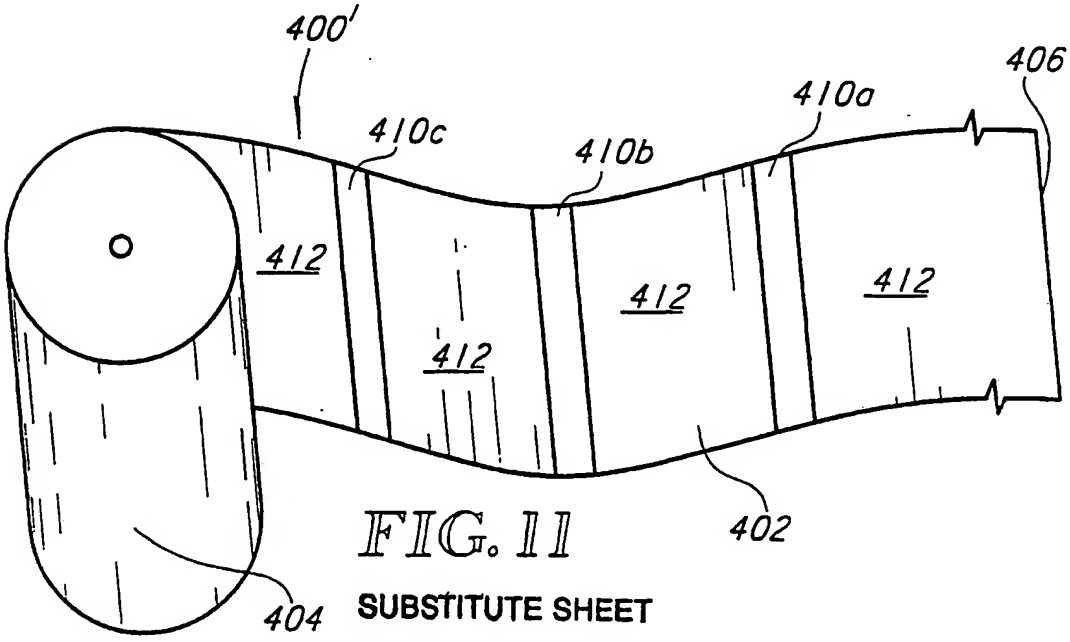


FIG. 11

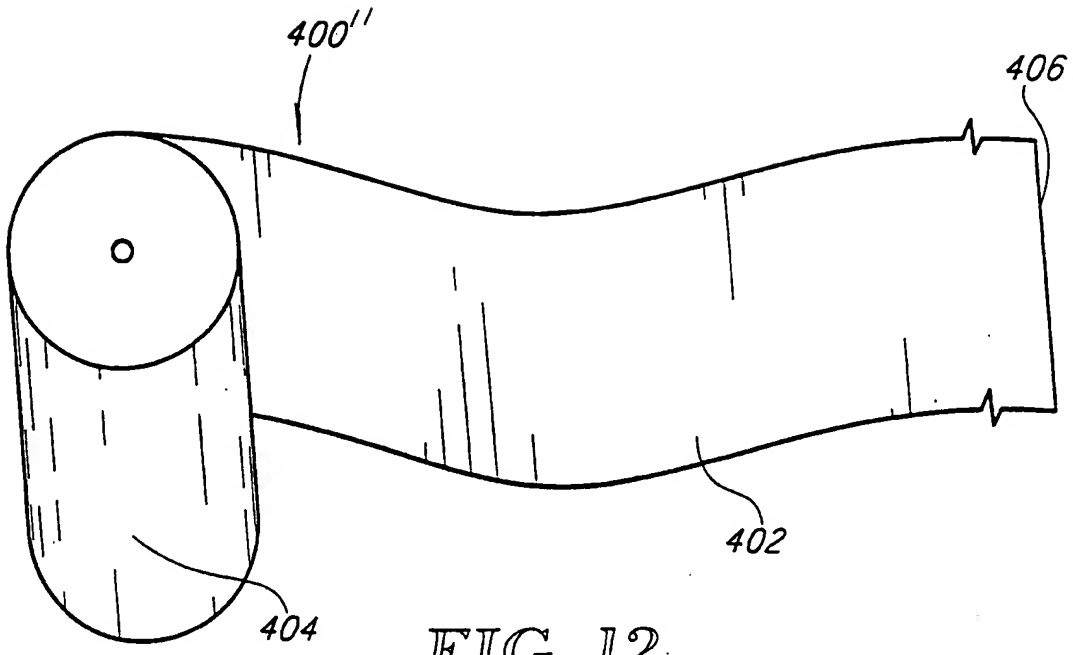


FIG. 12

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US93/03370

A. CLASSIFICATION OF SUBJECT MATTER
IPC(5) :B41J 29/17, 2/325
US CL :346/76PH; 400/701,702,120
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
U.S. : 346/76PH; 400/701,702,120

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US,A, 4,644,370 (Watanabe) 17 February 1987. see col. 5, lines 54-68; col. 6.	1-22
Y	JP,A, 60-49985 (Uchida) 19 March 1985 see entirely.	1-22
Y	JP,A, 62-297172 (Tsukamoto) 24 December 1987 see entirely.	1-22
Y	JP,A, 61-31279 (Kawakami) 13 February 1986 see entirely.	1-22
Y	JP,A, 1-242278 (Onishi) 27 September 1989 see entirely.	1-22

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be part of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search
25 MAY 1993

Date of mailing of the international search report
08 JUL 1993

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